

ZOOLOGY.—*Some exotic terrestrial isopods (Isopoda: Oniscoidea) from New York State.*<sup>1</sup> WILLIAM B. MUCHMORE, University of Rochester. (Communicated by Alan Stone.)

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The great majority of the terrestrial isopods found in northeastern United States have undoubtedly been introduced from Europe. Some of the immigrants have been more successful and have become more widely distributed than others and at present are among our commonest sowbugs and pillbugs. In upstate New York, for example, the following European species have been reported and may be present locally in great numbers:

*Oniscus asellus* Linnaeus  
*Porcellio scaber* Latreille  
*Porcellio spinicornis* Say  
*Metaporphus pruinosis* (Brandt)  
*Cylisticus convexus* (De Geer)  
*Tracheoniscus rathkei* (Brandt)  
*Armadillidium vulgare* (Latreille)

On the other hand, several species are represented in the local fauna which have been reported from the United States only infrequently. These are:

*Trichoniscus pygmaeus* Sars  
*Hyloniscus riparius* (C. L. Koch)  
*Miktoniscus medcofi* Van Name  
*Haplophthalmus danicus* Budde-Lund  
*Platyarthrus hoffmannseggii* Brandt  
*Armadillidium nasatum* Budde-Lund

To add to the information concerning the ecology and distribution of these less common forms, the following notes are presented.

***Trichoniscus pygmaeus* Sars**

This species has so far been reported from North America only three times. Lohmander (1927) reported specimens found in New York on lily bulbs imported from Scotland (not from Sweden as stated by Van Name, 1936, and Palmén, 1951), and Van Name (1940) reported the finding of a number of specimens in the Garfield Park Conservatory, Chicago, Ill. Recently Palmén (1951) has found a few specimens in two locations in Newfoundland. These two latter finds

were both from gardens and represent the first outdoor records for this species from North America. On the basis of these finds, Palmén predicted that *T. pygmaeus* would turn out to occur in further localities on this continent. This prediction has been borne out by the following New York collections:

Rochester, Monroe County, near the Mount Hope Cemetery; numerous specimens found on several occasions along railroad tracks, with *Hyloniscus riparius* and *Haplophthalmus danicus*.

Rochester, Monroe County, Durand-Eastman Park, May 22, 1955; 11 ♂♂ and 8 ♀♀ in debris between large rocks at edge of Lake Ontario, with *Trichoniscus demivirgo*, *Armadillidium nasatum*, and *Tracheoniscus rathkei*.

Bridgewater, Oneida County, June 19, 1955; 2 ♂♂ and 1 ♀ under rocks and trash on bank of small stream at side of highway, with *Trichoniscus demivirgo*.

Rensselaerville, Albany County; many specimens found on several occasions under rocks in ruins of an old felt mill on the E. N. Huyck Preserve, with *Trichoniscus demivirgo* and *Cylisticus convexus*.

It is certain that *T. pygmaeus* is an importation from Europe where it is widespread and synanthropic. It has in all probability been introduced into this country on numerous occasions and has obviously become established in a number of localities. The possibility that the populations discovered in New York represent very recent introductions is remote, since, with the possible exception of the Bridgewater locality, no recent dumping of vegetable wastes or soil has occurred at these stations. The Rensselaerville population, in particular, seems to be a very old one, since it is established around the foundations of an old felt mill which was abandoned in 1879 and fell into ruins before 1895. Many other old isolated populations such as these are undoubtedly scattered around the countryside, at least in the eastern United States. That they have not yet been discovered is certainly due to the very small size of the animal (<2.5 mm) and to its secretive habits, as well as to the scarcity of interested observers.

<sup>1</sup> Part of this work was done during tenure of a Summer Research Fellowship at the Edmund Niles Huyck Preserve, Rensselaerville, N. Y.

*Hyloniscus riparius* (C. L. Koch)

There is only one previous report of this widespread Central European form from North America. Palmén (1951) found several specimens in two locations in St. John's, Newfoundland—in a garden and in a greenhouse. From these finds he concluded that the species is probably not able to survive outdoors, but is completely dependent on man in Newfoundland.

In Rochester an apparently permanent outdoor population has been located near the Mount Hope Cemetery. Numerous specimens have been found under logs, rocks and debris over a distance of more than half a mile along a railroad embankment and on the cemetery grounds. Both sexes and all stages of the life history are represented. Active animals have been found on various occasions during the ice-free portion of the year, and their hardiness is attested to by the fact that they have just survived the most rigorous winter in Rochester for many years, the average temperature for December having been 24.4° F. and that for January 23.1° F. These points, together with the fact that the main body of the population along the railroad tracks has been separated from the cemetery (the probable point of origin) by a busy 4-lane highway for at least 25 years, indicate that this species is perfectly able to survive and thrive in such a climate as that of Rochester. In this connection it is interesting to note that in this same location where *H. riparius* is found, the exotic chilopod *Chaetechelyne vesuviana* (Newport) also occurs (cf. Crabill, 1955). These two species of organisms, which have somewhat similar ranges in Europe, apparently have similar ecological requirements and have been almost equally successful in establishing themselves in this foreign niche.<sup>2</sup>

It is very interesting to note that in the area along the railroad tracks *H. riparius* almost completely replaces the indigenous trichoniscid isopod, *Trichoniscus demivirgo* Blake. The latter species is common under rocks and logs in damp places throughout the Rochester region, and indeed, is abundant at the periphery of the area occupied by *H. riparius*. Within this area,

<sup>2</sup> Since preparation of this manuscript, a population of *Hyloniscus riparius* has been discovered in a small trash dump along U. S. Highway 20, 2.6 miles east of Lafayette, Onondaga County, N. Y.

however, very few *T. demivirgo* can be found, although, as mentioned above, the other trichoniscids *T. pygmaeus* and *H. danicus* occur in numbers along with *H. riparius*. It appears that *H. riparius* and *T. demivirgo* have very similar ecological requirements and that the former is more successful in its occupation of a favorable habitat than the latter, with the result that *T. demivirgo* is excluded almost completely.

*Miktoniscus medcofi* Van Name

In the greenhouse of the University of Rochester are several small, but thriving, colonies of a small isopod which has been identified provisionally as *Miktoniscus medcofi*. This species was described by Van Name (1940) from specimens found in the greenhouse of the University of Illinois, Urbana, Ill. At the same time Van Name reported specimens from another greenhouse in Urbana, and from the Garfield Park Conservatory, Chicago. The only other record of this species is the recent report by de Castro (1953) of specimens from three outdoor locations in Rio de Janeiro, Brazil. On the basis of these finds, de Castro suggests that Brazil may be the native habitat of the species.

Although he was confident in the identification of his specimens as *M. medcofi*, de Castro recognized certain peculiarities of his specimens and presented an extensive redescription of the species. In particular, he pointed out differences in the second pleopod, namely, the exopodite is larger in its terminal portion and the endopodite is proportionally much shorter than the corresponding structures as figured by Van Name (1940, p. 111). Furthermore, it should be noted that the Brazilian specimens are without pigment, while the United States specimens are described as "strongly pigmented, having the upper surface handsomely variegated with brown or purplish-brown pigment on a light background . . ." (p. 112). And the distal segment of the endopodite of pleopod I of the male is distinctly shorter than the proximal segment in Brazilian, but subequal in the United States specimens. Also, the basal segment of the uropod is apparently much narrower in Brazilian, than in United States specimens.

The specimens found at Rochester generally resemble those described by Van Name and de Castro but seem to differ from one or both forms in certain respects, namely, in the shape and proportions of the endopodite of pleopod II of

the male; in the shape of the isehium, merus and carpus of pereopod VII of the male; and in details of the antennae, pleopods III-V and uropods. In addition, it should be noted that these specimens are similar in many respects to specimens which have been described as *M. linearis* (Patience, 1908; Kesselyak, 1930; Vandel, 1950) and *M. humus* (Mulaik, 1942), though again certain differences are evident. Furthermore, Eberly (1954) has noted the finding in Cascades Park, Bloomington, Indiana, of a single specimen probably belonging to the genus *Miktoniscus*, but having "some differences from any of the species of *Miktoniscus* described from America." It seems certain that two or more species are represented by these several lots of specimens but, because of inaccuracies and inadequacies of the published descriptions, it is impossible at present to decide exactly what species are involved. As Vandel points out, it will not be possible to determine the identity or non-identity of the forms until a direct comparison of types can be made. Until such time as a positive identification can be made, it seems best to consider the Rochester specimens as belonging to *M. medcofi*, which they most closely resemble.

#### **Haplophthalmus danicus** Budde-Lund

This is another common European form which has been widely spread by man's activities. It has become established in a number of places in this country, living both indoors and out. It has been recorded outdoors from Indiana, Maryland, New Jersey, Pennsylvania, Kentucky, Tennessee, and Utah, and from greenhouses in Toronto, Ontario. Palmén (1951) has reported outdoor finds in southern Newfoundland and concludes from the circumstances that the species may be able to survive there. Eberly (1954) has found this species widely distributed in Indiana, frequenting "moist soil under boards and logs."

In New York I have found the species well established in the greenhouses of the University of Rochester, and in four outdoor locations as follows:

Rochester, Monroe County, near the Mount Hope Cemetery; number of specimens on several occasions, under logs along railroad tracks; with *Trichoniscus pygmaeus* and *Hyloniscus riparius*.

Powder Mill Park, Monroe County, April 1955; numerous individuals in two locations at least a mile apart; under logs on wet ground.

Rensselaerville, Albany County; large population in old trash on creek bank in the village; with *Trichoniscus demivirgo*, *Tracheoniscus rathkei*, and *Oniscus asellus*.

There is no doubt that these outdoor populations are permanent. Judging from the numbers of individuals found and from the surroundings, they cannot have been introduced recently. On the basis of these records, it appears that *H. danicus* can withstand rather rigorous winters, and in all probability will be found to be more widespread than supposed, even in the northern portion of the country and in southern Canada. As Eberly suggests, these small animals are probably "often overlooked because of their size, by people who think they might be just the young ones of other common species with which they are found."

#### **Platyarthrus hoffmannseggii** Brandt

This species also is widespread through Europe, being commonly found in the nests of ants, with which it apparently enjoys some sort of symbiotic relation. It has been reported in North America only from the vicinity of New Haven, Conn. (see Van Name, 1940, and Brooks, 1942).

In Rochester, a colony of *P. hoffmannseggii* has been found along the railroad tracks near the Mount Hope Cemetery, in the same area occupied by *Hyloniscus riparius* and other exotic forms. The colony is established in an ants' nest under an old railroad tie lying on the roadbed of stones and cinders. The nest is occupied by the ant, *Formica sanguinea subnuda* Emery and its slave *Formica fusca* Linnaeus.<sup>3</sup> On June 8 and June 27, 1956, brief collection by hand and Berlese separation of some of the material from under the tie yielded 69 specimens (25 males and 44 females), together with specimens of the other isopods *Haplophthalmus danicus*, *Hyloniscus riparius*, *Trichoniscus demivirgo*, *Oniscus asellus*, and *Tracheoniscus rathkei*.

Though I find no mention in the literature of such a situation, there seems to be a considerable difference in size between the sexes of *P. hoffmannseggii*. Contrary to the opinion of Brooks (1942, p. 436) that this species is "never more than four millimeters in length", and the statement of Edney (1953, p. 74), "up to 3.6 mm long", the largest female collected here is 5.76

<sup>3</sup> The ants were determined by Dr. Marion R. Smith at the United States National Museum.

mm long, and the average length of 33 mature females is 4.32 mm. On the other hand, the largest male collected is only 3.40 mm long, the average length of 23 males being 2.61 mm. It may be, of course, that all the males collected are immature animals, therefore are smaller than the females. But if this is so, then it must be assumed that mature males were not, at the time of collection, present in the colony, or else that the mature males were deep in the nest and escaped capture. Either of these situations should provide the basis for an interesting study.

The large size of female specimens and the size differential between males and females might suggest that we are dealing here with a species of *Platyarthrus* distinct from *hoffmannseggi* or with a subspecies of *P. hoffmannseggi*. No significant morphological differences have been detected, however, on comparing our specimens with the descriptions given by Meinertz (1934), Verhoeff (1936), and Edney (1953). Until direct comparison with European material should prove otherwise, it can only be concluded that our specimens are minor variants of *P. hoffmannseggi*.

#### *Armadillidium nasatum* Budde-Lund

This species has been widely reported through the U. S. and in southern Canada but its occurrence has for the greater part been confined to greenhouses and warmed buildings (cf. Van Name, 1936, and Hatchett, 1947). Only one report (Van Name, 1940) specifically mentions the finding of specimens (two) outdoors "under pieces of wood at Glenview, Illinois, northwest of Chicago, Oct. 3, 1936." There is no indication how close the point of capture was to human habitations or hothouses. Eberly (1954) notes that *A. nasatum* has been found in Brown and Monroe Counties, Ind., but he neglects to mention the habitats of the animals collected. It may be presumed, however, they do exist outdoors in these southern Indiana localities.

In Rochester, *A. nasatum* is very common in greenhouses at the University of Rochester and in Highland Park. In addition specimens have been found outdoors in four separate locations. Immediately around the university greenhouse, *A. nasatum* is very common through the summer months, along with *A. vulgare* and *Cylisticus convexus*. This population is without doubt one which winters in the building foundations and expands outside, with the coming of warm

weather. Further finds have been made, however, at stations some distance removed from any warmed building: under old wooden ties on a railroad embankment at Genesee Valley Park (2 ♂♂ on April 29, 1955; 3 ♂♂ on May 20, 1956); in a similar situation at the shore of Lake Ontario in Durand-Eastman Park (4 ♂♂ and 1 ♀ on May 22, 1955); and under a board in a trash dump of the Mount Hope Cemetery (1 ♀ on May 29, 1955). The latter specimen, while found outdoors, might have been carried to this place only shortly before collection on greenhouse flowers brought to the cemetery. The first two mentioned finds, however, seem certainly to be from permanently established populations, since in each case the station is not near a building and no reasonable mode of recent introduction can be conceived. It is probable that the animals are able to overwinter in these locations by burrowing deeply into the loose material of the railroad bed.

The population of *A. nasatum* living outside the greenhouse at the University of Rochester is actually a very hardy lot. Although they undoubtedly burrow deeply along the building foundations during the very cold weather, they apparently can tolerate temperatures near freezing, for immediately after the snow melted and the ground thawed from our past winter (March 30, air temperature about 35° F.) specimens were found active under a 1-foot-square piece of insulating board lying on the ground 2 feet from the building. Also present were individuals of *Cylisticus convexus* and *Tracheoniscus rathkei*. A few days later, after a 5½-inch snowfall, the snow was brushed away and a few specimens were found under the board, lethargic but still alive. This observation is noteworthy in view of the fact that Hatchett (1947) never found *A. nasatum* outside the greenhouse in Ann Arbor, Mich., even though inside it was as abundant as *A. vulgare*, which in turn was common outside as well as in.

#### DISCUSSION

The outdoor occurrence in upstate New York of *Hyloniscus riparius*, *Haplophthalmus danicus*, *Trichoniscus pygmaeus*, and *Armadillidium nasatum* is most interesting from a biogeographical point of view. These species are found throughout central and western Europe as far north as the North Sea coast. The last three named are also common in

the British Isles, but *H. riparius* apparently has not been introduced across the channel (see Edney, 1953); and *T. pygmaeus* and *H. danicus* have been reported from Norway (Oslo) by Sars (1898). In the cooler regions of Europe, which correspond climatically to upstate New York, these four species have been found only in greenhouses and other artificially warmed situations. Meinertz (1932, 1934) has reported all four in and around greenhouses in Denmark, and Palmén (1946, 1947) has found them in similar situations in Finland. Furthermore, in Newfoundland, which has a similar climate, *H. riparius*, *T. pygmaeus*, and *H. danicus* have been found living outdoors during the summer, but under such circumstances as to raise a doubt whether they are able to survive the winters outside (see Palmén, 1951).

The New York state localities, namely Rochester and Rensselaerville, are similar in climate to Denmark, southern Finland, and Newfoundland, at least in so far as the winters are concerned. In all these places the winters are fairly rigorous and damp, with the January temperature averaging 5 to 10 degrees below freezing, Fahrenheit. Considering climate alone, one would definitely not expect to find these isopods in either Rochester or Rensselaerville. Fortuitous circumstances have, however, made survival possible through the coldest winters experienced by these localities. All of my finds of the isopods under consideration have been made in situations where the substratum is very loose, that is, in railroad beds of rocks and cinders, in dumps of rocks, trash and ashes, and among crumbling building foundations. In such situations, apparently, the animals are well provided with food and moisture during warm weather and in cold weather are able to descend quickly to a depth sufficient to protect them from freezing.

*Platyarthus hoffmannseggii* also is widespread in Europe, being found as far north as the British Isles (Edney, 1954) and Denmark (Meinertz, 1934), but apparently absent from Norway (Sars, 1898) and Finland (Palmén, 1946). This species, being myrmecophilous, might be expected to be

more resistant to cold weather than many other isopods, since it always has the opportunity to retire easily to the depths of the ants' nest whenever conditions become adverse. On this basis, its occurrence in Rochester is easy to understand, and the possibility that it could withstand even more rigorous climates seems good.

The finding of *P. hoffmannseggii* with *Formica sanguinea subnuda* and *Formica fusca* adds these two forms to the list of ant hosts in this country. It should be noted, however, that in England the isopod has been found living with *F. fusca* and with the typical form of *F. sanguinea* (see Brooks, 1942, p. 428). It seems probable that the isopod was introduced from Europe into Rochester along with *F. fusca* and that subsequently the local ant, *F. sanguinea subnuda*, moved in to enslave *F. fusca* and to share the nest with its other occupants.

The geographical distribution of the several species in the genus *Miktoniscus* has been discussed by Vandel (1949, 1950), who points out that *Miktoniscus* is a typical North Atlantic genus. The recent suggestion of de Castro (1953) that *M. medcofi* originated in the southern hemisphere may or may not be valid. Two of the three finds of *M. medcofi* mentioned by de Castro were made in areas modified by human habitation, that is, in a banana grove and on a country estate. (Habitat data for the third find is not given.) It is entirely possible that the species has been introduced into the Rio de Janeiro region from some North American or European locality and that it has become locally established there, where it should have no difficulty in living outdoors. Only further, more intensive, collection can cast more light on this problem.

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## REFERENCES

- BROOKS, J. L. *Notes on the ecology and the occurrence in America of the myrmecophilous sowbug, Platyarthrus hoffmanseggi Brandt.* Ecology **23**: 427-437. 1942.
- CASTRO, A. L. DE. *Fauna do Distrito Federal. VIII. Sobre a ocorrência dos generos Miktoniscus e Cordioniscus no Rio de Janeiro (Isopoda, Trichoniscidae).* An. Acad. Brasil. Ciênc. **25**: 527-534. 1953.
- CRABILL, R. E., JR. *Report of another European chilopod in eastern North America (Chilopoda: Geophilomorpha).* Ent. News **66**: 248-249. 1955.
- EBERLY, W. R. *The terrestrial isopods (Oniscoidea) of Indiana.* Proc. Indiana Acad. Sci. **63**: 272-277. 1954.
- EDNEY, E. B. *The woodlice of Great Britain and Ireland.* Proc. Linn. Soc. London **164**: 49-98. 1953.
- HATCHETT, S. P. *Biology of the Isopoda of Michigan.* Ecol. Monogr. **17**: 47-79. 1947.
- KESSELYAK, A. *Über Isopoden.* Zool. Anz. **91**: 50-66. 1930.
- LOHMANDER, H. *On some terrestrial isopods in the United States National Museum.* Proc. U. S. Nat. Mus. **72**, (17): 1-18. 1927.
- MEINERTZ, T. *Die Landisopoden Dänemarks. I. Die Ligiiden und Trichonisciden.* Zool. Jahrb. (Abt. Syst.) **63**: 352-406. 1932.
- . *Die Landisopoden Dänemarks. II. Die Oniscoidea.* Zool. Jahrb. (Abt. Syst.) **66**: 211-284. 1934.
- MULAİK, S. and D. *New species and records of American terrestrial isopods.* Bull. Univ. Utah **32**, (6) (Biol. Ser. 6, no. 7): 1-11. 1942.
- PALMÉN, E. *Die Landisopoden Finnlands.* Ann. Zool. Soc. Zool. Bot. Fenn. **11**, (6): 1-36. 1946.
- . *Zur Kenntnis der Trichonisciden (Isopoda terr.) Finnlands.* Ann. Zool. Soc. Zool. Bot. Fenn. **13**, (1): 1-23. 1947.
- . *A survey of the Oniscoidea (Isopoda terr.) of Newfoundland.* Ann. Zool. Soc. Zool. Bot. Fenn. **14**, (1): 1-27. 1951.
- PATIENCE, A. *On a new British terrestrial isopod (Trichoniscus linearis, sp. n.).* Ann. Mag. Nat. Hist. (8) **1**: 280-282. 1908.
- SARS, G. O. *An account of the Crustacea of Norway (with short descriptions and figures of all the species). Vol. II. Isopoda: 1-270.* Bergen Museum, 1896-1898.
- VANDEL, A. *La faune Nord-Atlantique.* Rev. Fran. Ent. **16**, (1): 1-12. 1949.
- . *Isopodes terrestres recueillis par C. Bolívar et R. Jeannel (1928) et le Dr. Henrot (1946). Campagne spéologique de C. Bolívar et R. Jeannel dans l'Amérique du Nord (1928) No. 14.* Biospéologica **71**: Arch. Zool. exp. gén. **87**: 183-210. 1950.
- VAN NAME, W. G. *The American land and fresh-water isopod Crustacea.* Bull. Amer. Mus. Nat. Hist. **71**: 1-535. 1936.
- . *A supplement to the American land and fresh-water isopod Crustacea.* Bull. Amer. Mus. Nat. Hist. **77**: 109-142. 1940.
- . *A second supplement to the American land and fresh-water isopod Crustacea.* Bull. Amer. Mus. Nat. Hist. **80**: 299-329. 1942.
- VERHOEFF, K. W. *Ueber Isopoden der Balkanhalbinsel, gesammelt von Herrn. Dr. I. Buresch. III Teil, zugleich 58. Isopoden-Aufsatz.* Mitt. naturw. Inst. Sofia **9**: 1-27. 1936.

## WIND RIVER FOSSILS

Finding of a "missing link" in the evolution of modern mammals—a creature that had branched off from the great family of odd-toed ungulates, which includes the horse and rhino, toward the present tapir—is reported by C. Lewis Gazin, Smithsonian Institution curator of vertebrate paleontology.

This ancient animal, of which a fossil jaw and parts of a skull were found in the Wind River basin of Wyoming, was *Dilophodon*, about the size of a fox, which lived during the upper Eocene period of geological time, about 45,000,000 years ago. The Wind River area long has been a favorite hunting ground for mammals of the Eocene, the period when the warm-blooded creatures began to take on some of their present forms.

Also encountered were the fossil remains of a somewhat larger tapiroid, *Desmatotherium*, rather resembling the smaller tapir, *Dilophodon*, but cannot be considered directly ancestral to any living form although representative of the general complex from which arose rhinos, horses, tapirs, and certain groups of extinct hoofed mammals.

The points at which the divergence to the modern forms took place are of considerable significance to paleontologists. The Wind River area, Dr. Gazin says, is especially rich in tapiroid material and living in the same area, at roughly the same time, were ancestral opossums, rabbits, rodents, and carnivores.